# Economic Assessment for Climate Action in California

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# Objectives

1. Improve visibility for policy makers and other stakeholders.
2. Rigorously estimate direct and indirect impacts and identify real adjustment effects.
3. Promote empirical standards for policy research and dialogue.

# Why a state model?

1. California needs research capacity to support its own policies
   - A first-tier world economy
2. California is unique
   - Both economic structure and emissions patterns differ from national averages
3. California stakeholders need more accurate information about the adjustment process
   - National assessment masks extensive interstate spillovers and trade-offs

# Why a General Equilibrium Model?

1. *Complexity* - Given the complexity of today's economy, policy makers relying on intuition and rules-of-thumb alone are assuming substantial risks.
2. *Linkage* - Indirect effects of policies often outweigh direct effects.
3. *Political sustainability* - Economic policy may be made from the top down, but political consequences are often felt from the bottom up. These models identify stakes and stakeholders *before* policies are implemented.

# Model Structure

The modeling facility consists of two components:

1. Detailed economic and emissions data
   - 125 production activities
   - 10 household groups (by tax bracket)
   - detailed fiscal accounts
   - 14 emission categories
2. Berkeley Energy And Resource (BEAR) Model – a dynamic GE forecasting model

# Economy-Environment Linkage

Economic activity affects pollution in three ways:

1. *Growth* – aggregate growth increases resource use
2. *Composition* – changing sectoral composition of economic activity can change aggregate pollution intensity
3. *Technology* – any activity can change its pollution intensity with technological change

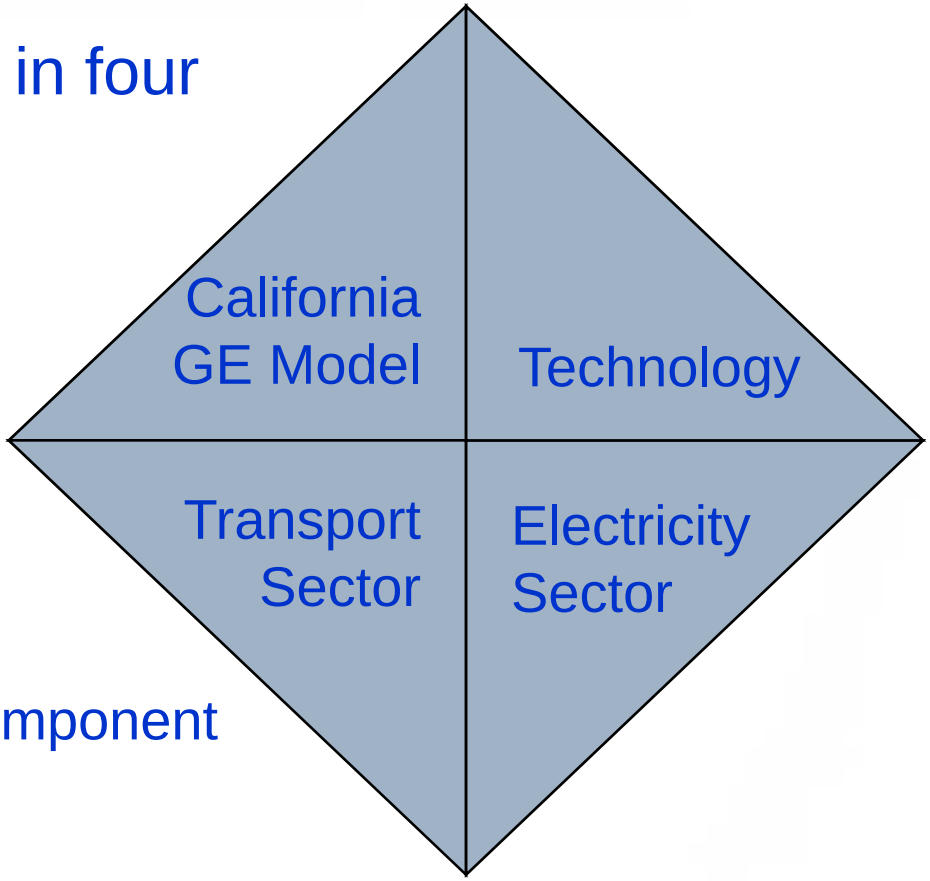
All three components interact to determine the ultimate effect of the economy on environment.

# How we Forecast

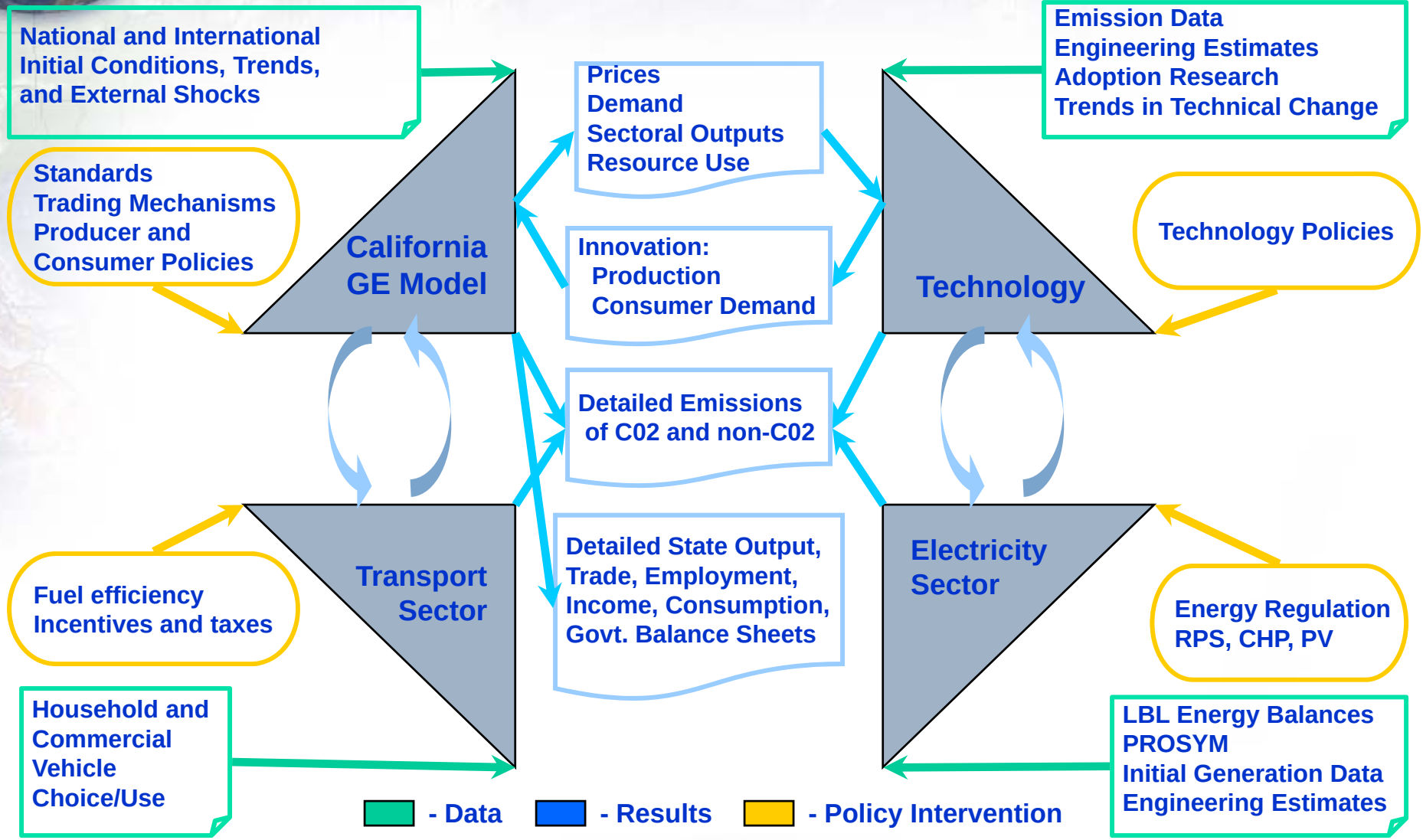
BEAR is being developed in four components.

Components:

1. Core GE model
2. Technology module
3. Electricity modeling
4. Transportation component



# Detailed Methodology



# Aggregate Results

Table D4.1: Impacts on Real State Output (% Change from Baseline)

| Scenarios | BEAR | I-Cap | I-All |
|---|---|---|---|
| CAT | -0.13% | | |
| Scenario 1 | -0.10% | 1.17% | 8.96% |
| Scenario 2 | -0.20% | 1.17% | 8.94% |
| Scenario 3 | -0.10% | 1.17% | 8.96% |
| Scenario 4 | -0.10% | 1.17% | 8.96% |
| Scenario 5 | -0.20% | 0.01% | 8.95% |
| Scenario 6 | -0.10% | 0.02% | 8.96% |
| Scenario 7 | -0.20% | 1.15% | 8.91% |
| Scenario 8 | -0.30% | -0.06% | 8.83% |
| Scenario 3* | -0.20% | NA | NA |

Table D4.2: Impacts on Personal Income (% Change from Baseline)

| Scenarios | BEAR | I-Cap | I-All |
|---|---|---|---|
| CAT | -0.60% | | |
| Scenario 1 | -0.60% | -0.09% | 3.98% |
| Scenario 2 | -0.70% | -0.09% | 3.87% |
| Scenario 3 | -0.60% | -0.09% | 3.98% |
| Scenario 4 | -0.60% | -0.09% | 3.98% |
| Scenario 5 | -0.60% | -0.52% | 3.96% |
| Scenario 6 | -0.60% | -0.50% | 3.98% |
| Scenario 7 | -0.70% | -0.18% | 3.87% |
| Scenario 8 | -0.90% | -0.70% | 3.72% |
| Scenario 3* | -0.80% | NA | NA |

Table D4.3: Impacts on Employment (% Change from Baseline)

| Scenarios | BEAR | I-Cap | I-All |
|---|---|---|---|
| CAT | 0.05% | | |
| Scenario 1 | 0.20% | 0.87% | 6.27% |
| Scenario 2 | 0.10% | 0.87% | 6.25% |
| Scenario 3 | 0.20% | 0.87% | 6.27% |
| Scenario 4 | 0.20% | 0.87% | 6.27% |
| Scenario 5 | 0.10% | 0.17% | 6.26% |
| Scenario 6 | 0.20% | 0.17% | 6.27% |
| Scenario 7 | -0.10% | 0.82% | 6.19% |
| Scenario 8 | -0.50% | 0.05% | 6.10% |
| Scenario 3* | -0.20% | NA | NA |

Table D4.4: Estimated Emission Allowance Prices

| Scenarios | BEAR | I-Cap | I-All |
|---|---|---|---|
| CAT | - | | |
| Scenario 1 | $22 | $15 | $5 |
| Scenario 2 | $7 | $4 | $7 |
| Scenario 3 | $22 | $15 | $5 |
| Scenario 4 | $22 | $15 | $5 |
| Scenario 5 | $80 | $53 | $24 |
| Scenario 6 | $17 | $10 | $1 |
| Scenario 7 | $206 | $151 | $87 |
| Scenario 8 | $442 | $318 | $226 |
| Scenario 3* | $9 | NA | NA |

# Results Interpretation

1. Aggregate Real Effects on the Economy are Small (Growth is not Threatened)
2. Individual Sector Demand, Output, and Employment can Change Significantly (Economic Structure Changes)
3. Combined Effects of the Climate Action Policy Packages have Net Effects On Individual Sectors that Cannot be Identified in Sector-specific Policy Analysis
4. Real Output and Employment Effects are Smaller than in Previous BEAR Results
5. Employment Effects are Positive in the Majority of Scenarios
6. No Significant Leakage is Observed in the BEAR Scenarios
7. No Forgone Damages are Taken into Account

# Three Economic Principles

1. Demand Shifting: New demand is more likely to be for California goods and services.
2. Benefits Exceed Costs: Direct adjustment costs seem high to stakeholders in the short term, but these are usually outweighed by many indirect statewide benefits.
3. Early Action Pays: Conversion costs are fixed, but benefits compound like interest.

# Extensions

- More detailed program characteristics, especially market and incentive based approaches (e.g. auctions, allocation, offsets, safety valves, etc.)
- Innovation potential
- Spatial and institutional heterogeneity
- Integration with damage assessment

Thank you.